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ABSTRACT

This paper addresses the library collection development of spatial information in cartographic format. Highlights include: the impermanent nature of maps; changes in spatial information creation, storage, processing, and management resulting from developments in computer-based information technology; steps required to download the digital version of a USGS (U.S. Geological Survey) map; acquiring map material that is not in a standard distribution network; MapQuest, an Internet mapping business; and Mapnet, a tool for visualizing the Internet. The following observations are noted in conclusion: (1) maps, either paper or digital, are elusive; (2) maps are transformative; (3) libraries have well-defined roles; and (4) networked maps are innovative and unpredictable. (MES)

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The impermanence of maps in the information age

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Paper

It seems to me that maps are, by their nature, reports. Rarely lyrical or narrative, maps report either the state of the earth's surface, a plan for the earth's surface or a report of people and resources on the earth. The earliest existing map, a property survey pressed into a wet clay tablet and found in the Nineveh library is indicative of the reporting nature of maps. It's cousin document, a blueprint survey in the Mansfield Town Hall in Mansfield, Connecticut, USA, of the McGlamery's property is not that distant a relative. Both are "records of understanding" or contracts of ownership. Of course there are fictional maps: allegorical maps of fairylands, maps of heaven and hell, maps of worlds created in novels and conceptual maps of land developments. However, most maps are representative of the earth's surface and are cartographic reports of scientific information.

I maintain that maps are not **meant** to be long-lived. They are created to satisfy a particular scientific hypothesis that relates to time and space. For example, a topographic survey of the Spring Hill Quadrangle, where I live. This map was published by the US Geological Society in 1897, 1947, 1957, 1967, and 1987. Each edition or revision was created to portray this particular place in time. There is no cartographic intent to transition, or synthesize changes in the landscape, physical or administrative. While the user can infer changes, by comparing one edition to the other, it is not the intent of the map to show changes. Each map is simply a report of the topographic state of Spring Hill at a point in time. One can only get the most recent edition from the US Geological Survey. The back issues are available from libraries and archives… map libraries. These libraries have collected, preserved and cataloged the maps knowing that if they didn't, **the maps would disappear**. The scientific process would use them up, consume them. Maps are, by their very nature, impermanent.

This is different than books. Written scientific reports certainly exist. But there are other

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genres such as fiction, history, biography, and poetry, which are as vital now as when they were first written down. The Ramakien, the Bible, Shakespeare's plays have not changed significantly over the centuries. They were meant to last, to be a permanent part of the cultural environment. Issues of the permanence of the content of these works and artifacts are significantly different than for maps.

The impermanent nature of maps, therefore, is grounded in its **content**. This is an important distinct to make. This paper is concerned more with the collection development of spatial information in cartographic format than it is with the preservation of material. . Map content has been extremely fragile, residing as it has on single sheets of paper. While preservation of physical materials is critical, unless the information content is recognized as important enough to collection and manage, preservation will never be undertaken. For while maps are impermanent on either paper or digital media, they are totally lost if the information professional, that is the librarian or archivist, fails to recognize their true cultural worth in the first-place and does not add them to a managed collection.

Maps have always had a habit of falling through the cracks in the publishing distribution system. They have always suffered a backwater existence in mainstream publishing… and in libraries. While maps probably are represented in all libraries and archives, typically they are under-cataloged, under-preserved and poorly stored and retrieved. Sheet maps are large, fragile and pretty. Often they hang on walls… until they either fade or fall off… Be that as it may, the mission of the library is to collect, describe and provide access to information; and in the case of maps spatial information.

Maps are often considered working papers by an agency. They end up off, at the end of the stack, rolled up and stuffed in a box. In agencies they are most often collected until there is a need for space, and then they are dumped. Or saved. If they are fortunate enough to be saved they are often separated from textual material, or indices, the parts of the larger project. While state and federal agencies are often required to archive their published materials with a library or archives, there often are no requirements to archive 'working papers.'

An aggressive collecting strategy for the research library is to make its archival mission known to the agency or author. When the agency realizes that a library will take the material that they have collected, they will more often than not, deposit it with the library. After all, they thought enough of it to keep it neatly rolled for all those years. Periodic letters of interest to agencies only need to work once in order to save one-of-a-kind material.

Preservation of paper maps is well documented and the IFLA Geography and Map Section has a program for teaching map preservation strategies and tactics around the world. Today I want to focus on the uniques issues of the impermanence of digital spatial information.

Few information formats have been as profoundly effected by digital computing as maps. In 1999, the issue before us with spatial information is not simply one of maps. Maps have always been compilations of datum writ graphically… cartographically. The art and craft of cartography draws the coordinate numbers as points and lines, classes and colors a country's population. The user, the map-reader, never sees the numeric data, though they can extrapolate the value if a grid or legend is given.

Twenty years ago, debate raged over the definition of cartography and maps. The International Cartographic Association (ICA) invited re-definitions of cartography in light of innovations in computer technology. Two camps emerged, stressing the importance of the map on one hand, and the spatial database on the other. M. Visvalingum articulated a middle ground, focusing not on product, but on content. She said, "If cartography is concerned with the making and use of maps, then it is not just concerned with visual products: it is equally concerned with the processes of mapping, from data collection, transformation and simplification through to symbolism and with map reading, analysis and interpretation. These intellectual processes are expressed in terms of prevailing technologies and computer-based Information Technology is

fast becoming the dominant technology of the day." (Visvalingum, 1989)

The past ten years have seen profound changes in spatial information creation, storage, processing and management. In the past decade, the dropping costs of computer and network charges and the ready availability of computer mapping and 'GIS' or Geographic Information Systems software should alert the information professional to emerging issues of permanence of spatial information.

In the United States economic considerations have required the Geological Survey to re-evaluate its printed map production.

The USGS's Open-file Reports, begun thirty years ago, have include unpublished manuscript reports, maps, and other material that are made available for public consultation at depositories. These reports are a nonpermanent form of publication that may be cited in other publications as sources of information. Typically this series has been distributed on microfiche to depository libraries. Though they are not cited in the private *Guide to USGS Publications*, they are listed in the public document *Publications of the U.S. Geological Survey*.

In recent years the USGS scientist has been able to overcome the economics of print technology by publishing digitally. USGS Open-file Report 99-149 "Geology and Mineral Deposits of the Keweenaw Peninsula, Michigan" is an excellent example of such a report. The geologic map included in this report was compiled in Arc/Info, a Geographic Information System, or GIS . The complete report contains: 1.) color maps as image files 2.) text describing the geology 3.) spatial database files. Instead of the viewing the map, the user must now 'process' it. The many steps in OF99-149 <http://pubs.usgs.gov/openfile/of99-149/index.html> require that the user:

- Consult the readme.txt file for a complete description of the report, including instructions for downloading and importing the files.
- View the database explanation as an unformatted, ASCII text file: readme.txt (14 Kb)
- View the text pamphlet of the report in Adobe Acrobat Portable Document Format: of998pam.pdf (397 Kb). Go to Adobe Acrobat to download the free Acrobat Reader software if you you don't already have it. The PDF file is 18 pages on 8.5" x 11" paper and prints best on a 600 dpi laser printer.
- Download the compressed data files in unprojected geographic coordinates with units in decimal degrees of998.tar.gz (1.3 Mb)
- Download the compressed data files in Michigan Stateplane coordinates with units in feet: of998198.tar.gz (1.5 Mb)
- Download the compressed file for printing the paper map (34" tall x 66" wide) in PostScript format. The map was designed and tested on Hewlett Packard DesignJet 650, 750, and 2500 series printers. Select this option if you have access to a large format printer capable of plotting PostScript files: of998.ps.gz (4.2 Mb compressed and 20.8 Mb uncompressed). This file has been successfully printed from Arc/Info, Adobe Illustrator, and from the MS-DOS prompt using the "print" command.
- Download the compressed Arc/Info graphics file: of998.gra.gz (1.8 Mb compressed and 6.0 Mb uncompressed). This file will only plot in Arc/Info.
- Order a paper copy of the map from the USGS Maps on Demand facility.
- View the metadata files for the Arc/Info coverages.

- View parts of the map in Adobe Acrobat Portable Document Format. These parts are sub-sets of the full paper map, and can be used for on-screen viewing.

Previously this report would have been relegated to a black and white microfiche publication. It would have lived an obscure and grainy existence. The user's ability to 'process' the information would have been to print a copy of a part of the map at high or low resolution. While the microform series continues, less material is going in.

Despite its complexity, the digital version is an resounding improvement, limited only by the users' hardware capabilities, as we shall see.

The USGS defines a digital map product as data intended both for display as a map and for processing by scientific or technical application software. The data may be geologic, geo-chemical, or geophysical databases, sample locations, or associated text. This subsumes the range of products that the Division has included in *the Miscellaneous Geological Investigations*-and *Miscellaneous Field Studies* series, and their predecessor series. This definition does not include geo-referenced data that are not intended for viewing as a map; the best examples of these are time series at specific point locations. Stand-alone raster images (e.g. satellite data) are not here considered as digital map products; however, such raster imagery may form one layer of a digital map product when it is accompanied by other interpretative geologic map information.

Currently, the USGS uses conventional lithographic printing techniques to produce paper copies of the majority of its mapping products. This practice is not economical for those products where the demand is low. With the advent of newer technologies, high speed, large format printers have been coupled with innovative computer technologies to turn digital map data into a printed map. It is now possible to store and retrieve data from vast geospatial data bases, and print a map on an as-needed basis, that is print on demand--thereby eliminating the need to warehouse a paper inventory of maps for which there is low demand. (USGS, 1999)

Using print-on-demand technology, USGS is implementing map-on-demand (MOD) printing, for selected infrequently requested map products. By providing MOD products, USGS can provide an alternative to traditional large volume printing and can improve the responsiveness to customers by providing access to USGS scientific data in a format that other wise might not be available.

However, we should not assume that what the USGS is doing with published digital maps is necessarily what others are doing. The USGS is an example of excellent distribution of this emerging cartographic format. The Survey and the US Depository Library program bring these digital maps to the libraries door. The more critical problem is acquiring map material that is not in a standard distribution network.

Indeed the maps published by ESRI in their *Map Book* series are representative of maps produced by the ARC/INFO program by private and public agencies internationally. ARC/INFO is a world leader in GIS software. Each year since 1985 users have gathered to share examples of digital cartography in the ESRI User's Conference. Each year maps are exhibited and the 'best of show' are published in a glossy presentation volume. The series is a good representation of the evolution of computer based mapping. The contemporary cartographer can now plot a limited number of high quality color maps for decision-makers in the office, rather than incurring the costs of time and money of traditional map publishing. In the past decade report map publishing has declined while individual map creation has increase. We can speculate that less than 20 copies of a map are plotted, 19 for reports and one for the cartographer to put up in his or her cubicle.

These maps are typically not collected in libraries because they exist outside the publishing system. They are not created for sale. They are created as reports and as one-time use for decision making. What this means is that the paper trail created in the past is broken in the

digital age. The impermanence of maps will make the reconstruction of our thoughts and worldviews all that much more difficult for historians in the future. The Map Book maps have only one thing in common; the cartographers used ARC/INFO to create them. We only know of them because the cartographers wanted to share them with the cartographic community, not with an extended community of users. Librarians need to collect more aggressively in order to insure that these sorts of maps will be shared with a broader community.

A brief bibliographic search of maps published in the *Map Book* series reveals that only since 1993, when ESRI began donating the selected maps to the Library of Congress, have these digital maps been cataloged. Libraries will have to market their skills as catalogers, indexers and conservators to the burgeoning community of digital map publishers if we hope to preserve of cartographic history.

Maps generated on the Internet represent an even more fragile picture of digital cartography.

MapQuest, the Internet mapping business, is the largest map publisher in the history of the cartography. More maps have been produced in the past seven years than ever before. MapQuest uses maps as navigational tools, but mapping is also a powerful visualization tool. Now, as data visualization emerges as the new 'killer app' maps are quickly being integrated into information standards.

Mapnet is a tool for visualizing the Internet. Visualization beyond the purview of a single provider has become a challenging task that has received little attention from the research community. Commercial Internet service providers grow increasingly hesitant to voluntarily publish topology or peering information about their networks, and those that do so use no standard format, leading to the problem that any existing maps are fairly incomparable with each other. At the same time, the evolution of cooperative research networks, currently framed by the U. S. National Science Foundation, new connections to the very Broadband Network System (vBNS) and cooperating U.S. federal agencies, has given rise to the desire to be able to share performance information across infrastructures, perhaps even commercial ones.

Mapnet has developed a tool for visualizing the dynamic infrastructure of multiple backbone providers simultaneously, and for updating and correcting information that may be invalid or out of date (Mapnet Update). The tool's accuracy relies on the cooperation of providers in keeping the information accurate. Mapnet is also developing a module that will allow one to request performance or routing information across arbitrary points of the infrastructure amenable to measurement.

Mapnet begs the question of map publishing in a different way than MapQuest, it explores the notion of data visualization. Is this publishing? The Mapnet map is a map of relationships, not of wires in the ground or under the water. If it is part of a dynamic decision making process that is a cartographic snap-shot of the state of the InterNet.

In conclusion, maps have always been an impermanent part of our information environment. Maps are inherently "reports." As spatial information transitions from paper to digital, the library community will need to monitor both media. There are a number of map collecting issues which are worth noting:

- Maps, either paper or digital, are elusive
    1. Maps are often part of a textual report, seen as addenda, and overlooked.
    2. Paper maps are easily separated from other parts of the report.

- Maps are transformative
  Paper maps are a presentation of compiled data, which computer-based Information Technology can include as a spatial database.

- Libraries have well defined roles

1. Strong collection development policies that respond to the users needs, and not just to the publisher's catalogs are important.
2. Cataloging maps and cataloging spatial data are changing and evolving with developing spatial metadata standards.
3. Preservation and archiving of digital spatial data is poorly defined, but practitioners understand the issue.

- Networked maps are innovative and unpredictable
  1. The networked environment is introducing new types of maps and data visualization.
  2. New networked communities are new information consumers.

During this time of continuing transition, librarians should be extra diligent. The vagaries of information at the end of the Twentieth Century are severe. Maps and spatial data are particularly susceptible. The library community should take a leadership role, defining the problems and developing solutions. However, it is incumbent on librarian's to take the responsibility for collecting these impermanent information artifacts.

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